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REPORT

OF

CONNECTICUT VALLEY WATERWAY BOARD ON AN INVESTIGATION OF THE CONNECTICUT RIVER.

MARCH, 1913.

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The Commonwealth of Massachusetts.

To the Honorable the Senate and House of Representatives of the Commonwealth of Massachusetts.

The Connecticut Valley Waterway Board, appointed under the provisions of chapter 149 of the Resolves of 1912, respectfully submits this report.

The resolve provided: —

That the governor, with the advice and consent of the council, is hereby authorized to appoint three persons, residents of the commonwealth, one of whom shall be a member of the board of harbor and land commissioners. The persons so appointed shall constitute a board to be known as the Connecticut Valley Waterway Board. The governor shall designate the chairman of the board. It shall be the duty of the board to investigate the subject of the improvement of the Connecticut river for the purposes of navigation, and to report to the next general court not later than the first day of February all facts concerning the present condition and uses of said river; what investigations, reports, appropriations and expenditures have been made by the United States and by the commonwealth of Massachusetts relative to the navigation of said river and the protection of the river banks; and what action, if any, should be taken by the commonwealth of Massachusetts and the various municipalities bordering on said river or contiguous thereto, either in co-operation with the United States and the various corporations owning or controlling water rights or privileges on said river, or without such co-operation, to carry into effect such projects as may be recommended for increasing the present facilities for navigation. The board may expend a sum not exceeding two thousand five hundred dollars to meet such expenses as may be necessary in carrying out the purposes of this resolve. The report shall contain data as follows:

(*a*) The existence and establishment of both private and public terminal and transfer facilities contiguous to the navigable water proposed to be improved, and, if water terminals have been constructed, the general location, description, and use made of the same, with an opinion as to their adequacy and efficiency whether private or public. If no public terminals have been constructed, or if they are inadequate in number, there shall be included in the report an opinion in general

terms as to the necessity, number, and appropriate location of the same, and also the necessary relations of such proposed terminals to the development of commerce.

(*b*) The development and utilization of water power for industrial and commercial purposes.

(*c*) Such other subjects as may be properly connected with such project: *provided,* that in the investigation and study of these questions consideration shall be given only to their bearing upon the improvement of navigation, to the possibility and desirability of their being co-ordinated in a logical and proper manner with improvements for navigation to lessen the cost of such improvements and to compensate the government for expenditures made in the interest of navigation, and to their relation to the development and regulation of commerce.

The board shall receive such compensation as the governor and council shall determine. [*Approved June 13, 1912.*

By an order of the Legislature adopted in concurrence on Jan. 29, 1913, the time within which the Board should report was extended to March 15, 1913.

The first meeting was held at the office of the Board of Harbor and Land Commissioners on Aug. 7, 1912. Public hearings have been given in Springfield, Holyoke, Chicopee, Northampton and Greenfield, and inspections made of the river from Springfield to its mouth in Connecticut, and of portions of the river above Springfield. Conferences have been held with the members of the Rivers, Harbors and Bridges Commission of Connecticut, who have been entirely in accord with this movement in Massachusetts and have materially assisted the Board in its inquiries. A map of the entire river in the States of Massachusetts and Connecticut has been prepared from surveys made by the United States government, by the State of Massachusetts, and from other sources, and accompanies this report. Statistics in relation to population, valuation, and the amount and character of the various industries carried on within the more important cities and towns bordering on the river have been collected, and other information has been gathered by personal inquiry and circular letters. The members attended a hearing in December before the Committee on Commerce at Washington relative to legislation with respect to the important subject of the relocation and construction of a dam and lock across this river at Windsor Locks in Connecticut.

At the public hearings held in Holyoke and Springfield, Governor Foss was present and spoke of the value of the development of inland waterways, of the urgent necessity for the opening of the Connecticut River to navigation, and of the tremendous commercial importance to the State of an unobstructed waterway from Holyoke to the sea.

It is impossible to mistake the sentiment of the cities and towns of the Connecticut valley. At every hearing the Board was welcomed by audiences both large and enthusiastic. Local speakers presented strong arguments, sustained by local statistics, to prove the need of the community for waterway transportation and its inevitable commercial advantages. In addition, letters were sent to the meetings by individuals and corporations in favor of the movement. The citizens of the Connecticut valley are demanding, not only in their own interest but in behalf of the commercial prosperity of the whole State, the opening to navigation of the Connecticut River from its upper reaches to the sea.

Early History of the River and its Uses.

The Connecticut River is for interior New England the great natural highway of commerce. From its source in Connecticut Lake, in New Hampshire, it flows southerly, forming the boundary line between that State and Vermont, thence through Massachusetts and Connecticut, emptying into Long Island Sound at Saybrook. The total length of river is about 345 miles, while its entire watershed exceeds 11,000 square miles. As a thoroughfare for trade it played in early New England history a part of tremendous importance.

By the close of the colonial period of New England history the Connecticut valley settlements had a thoroughly organized system of transportation upon this river from Wells River Junction in Vermont to Hartford and the sea. Above Hartford, flatboats plied between the various falls. It was the custom to unload freight at each fall, cart the same around the falls and reload upon flatboats above. From Hartford and points short distances above cargoes were transshipped to sloops or barks for transportation to Boston, to New York, to Barbadoes, to Jamaica or to England.

In the closing years of the eighteenth century, immediately following the Revolution, the development of inland waterways assumed a proportionate importance never since equalled. In the Connecticut valley plans were formulated for increasing the navigability of the river by means of a system of canals around the principal falls. Charters were issued to various companies by Vermont, Massachusetts, New Hampshire and Connecticut. Under these charters locks and canals were built at South Hadley and Turners Falls in Massachusetts; at Bellows Falls, Sumner Falls and White River Junction in Vermont; and, somewhat later, at Enfield in Connecticut.

The dams, canal and locks built in this locality in Connecticut have been the subject of controversy for several years, and have been described and commented upon in reports of the United States engineers. In the charter granted by the State of Connecticut in 1824 to the Connecticut River Company it was provided: —

> That the said corporation, for the purpose of widening the channel of said river, and deepening the same, shall have power to dig, cleanse, and remove obstructions from the channels and bars of said river, from and above the bridge at Hartford, to Springfield, and to erect and build wharves and piers and hedges in said river, or on the banks thereof; and the said corporation are empowered to lock the falls at Enfield, on said river, and to make channels to aid them, and to construct a canal on either bank of said river near said falls, and to construct a dam or dams for the purpose of entering or leaving the locks in still water; provided the extension and form thereof shall be such as shall not prevent the convenient passage of boats and lumber down the river, nor obstruct the passage of fish.

With the completion of these canals the Connecticut River entered upon its period of greatest commercial activity. From Hartford, Conn., to Wells River, Vt., the whole river was open to navigation. Freights were carried in flatboats, built for the most part 70 feet long, 15 feet wide and with a carrying capacity of from 30 to 40 tons. Through interior New England from Vermont to the sea over this great open roadway came a vigorous prosperity to the towns and cities of the Connecticut valley.

The application of steam to the problem of transportation, the invention of the steamboat and the steam engine sounded

the doom of commercial activity on this river above Hartford. Although the advent of steamboats upon the river was enthusiastically welcomed, failure followed upon failure in their use. Not only were the boats too large to pass through the locks and canals provided for the flatboats, but they were of too great draft to allow of safe navigation in the upper river. After various experiments a system of relay steamers was adopted, plying between the locks and canals somewhat after the fashion of the early flatboats. The loading and unloading of the freights, causing undue delay and increased expense, proved disastrous, and after two years the scheme was abandoned.

Neither comprehensive plans for adequate canal and river improvement nor enthusiasm for their achievement were lacking in this valley, but the first railroad had already secured its charter. Within ten years the new means of transportation had so extended its system that competition seemed hopeless. The locks and canals were abandoned for traffic, and above Hartford the great river was practically closed to commerce.

With the coming of the railroads, interest in the development of inland waterways was destroyed. The immediate commercial and financial returns of the railroads proved an irresistible lure. A kind of national stampede took place away from waterway development toward railroad construction. Schemes for the improvement of inland waterways were dismissed, half-completed projects were abandoned.

At the present time the river up to Hartford is principally used by the steamers and barges of the Hartford Transportation Company, owned or controlled by the New York, New Haven & Hartford Railroad Company. From Hartford to Springfield and Holyoke very little use is made of the river and that is practically confined to launches and small craft generally, although some coal has been carried to Springfield by the pioneers in this line, the Springfield Navigation Company, by means of small barges which could pass through the restricted locks and canal at Windsor Locks in Connecticut. It is well known, however, that this company is very much interested in procuring increased facilities for navigation, and is prepared to build additional barges for the transportation of coal to Springfield as soon as conditions will warrant. A small steamer plies during the

summer season between Springfield and a recreation ground down the river about 6 miles. Upstream as far as the rapids below the Holyoke dam considerable use of the river is made by motor boats and a steamer, but for commercial purposes very little use is made.

There is no navigation, except by small boats for pleasure purposes, above Holyoke as far as Turners Falls, and above Turners Falls to the State line, although there are possibilities for a large and highly profitable use of the river for commercial purposes all the way from the present head of navigation at Holyoke to and into New Hampshire and Vermont territory. Continuous and unobstructed navigation would require the restoration, with amplified dimensions and depths, and with suitable locks, of those canals which were provided in the early days of navigation on the river for passage around the rapids and falls, and which, most unfortunately, it seems to this Board, were allowed to be closed and abandoned.

The river as far down as Mount Tom station is used for floating logs. This business is carried on by the Connecticut Valley Lumber Company, which has built at various places booms and other protective structures. Those built since 1898 have been licensed by the Board of Harbor and Land Commissioners, the jurisdiction of that Board having been extended to this class of structures and encroachments on this river by chapter 498 of the Acts of 1898. The enactment of that statute made it possible to protect the boating interests, and this company, as well as other parties using this public waterway, have been heard, and matters in dispute adjusted from time to time without resorting to the courts.

In addition to the licensing of booms the Board of Harbor and Land Commissioners has approved many plans for building bridges, landings and other structures at various points.

Surveys, Projects and Improvements by the United States.

Previous to the year 1897 a number of surveys of the Connecticut River had been made by the federal government, the early ones, between 1871 and 1878, by Gen. T. G. Ellis, under the direction of Gen. G. K. Warren, Corps of Engineers. Some

were for the purpose of developing plans for improvement of the river between Hartford and Holyoke, and others covered that part extending from Hartford to the river mouth. There is a reference in one of the early reports to a compiled map, but it does not appear that the federal government has made any surveys to ascertain the depth of water in this river between the Holyoke dam and the northerly boundary line of Massachusetts.

In 1897 a survey was made of the river, from Hartford to Holyoke, under the direction of Maj. Smith S. Leach, whose report of Nov. 13, 1897, and the conclusions therein stated, have been often quoted and referred to in discussions and proceedings relating to the desirability and necessity for an improved river channel adequate for use by water craft of larger dimensions and carrying capacity, as far as Springfield and Holyoke.

In 1902 and 1903 surveys were made by Arthur J. Ober, junior engineer, under direction of a Board of Engineer Officers, of the stretch of river from Hartford to Holyoke. The report of this survey is very full and comprehensive, contains much information in detail, and is published with the report of the Chief of Engineers, U. S. A., for 1905.

The River below Hartford.

For the improvement of the river between Hartford and Long Island Sound, covering a length of about 50 miles, the first project, adopted in 1836, provided for the removal by dredging of the Saybrook Bar, where there was, previous to the commencement of operations, an available depth of 7 feet. At the shoalest of the river bars between this place and Hartford there was a depth of about 5 feet.

By dredging done some years later, a channel of from 11 to 12 feet was provided, but subsequently it was nearly obliterated by storms and freshets. Under a further project, adopted in 1870 and modified later, two jetties were built at Saybrook Bar, and protective works constructed at other localities in the river.

Under a project adopted in 1887, modified in 1890, a channel 200 feet wide and 12 feet deep at mean low water was dredged through Saybrook Bar between the jetties, and by annual dredging at the river bars a channel about 50 feet wide was kept open for the passage of steamers and barges.

A project for further improvement, adopted in 1911, provides for a channel 12 feet deep and 100 feet wide at mean low water from Hartford to the bar at the mouth of the river, and for a channel across the bar 300 feet wide and 15 feet deep at mean low water. It is reported that up to June 30, 1912, about 3 per cent. of the project had been completed.

The maximum draft which could be carried from Hartford to the Sound, at mean low water, on June 30, 1912, was about 10 feet. The reported tonnage for 1911 amounted to 683,326 short tons, valued at $23,537,837.81. The government engineers state that freight rates have been materially reduced by reason of the work done. The federal appropriations to Dec. 31, 1902, and subsequently to Aug. 24, 1912, inclusive, for improvement of the river up to Hartford, amount to a total of $799,010.90.

The River between Hartford and Holyoke.

As river conditions between Hartford and Holyoke are what Massachusetts is particularly interested in at this time, reference is made to the examinations, surveys and plans of 1871–78, and to those subsequently made, which, together with the various reports of the Chief of Engineers, U. S. A., and those prepared by the officers of the Engineer Corps, cover the subject with great detail. These are summarized as follows: —

The section of river between Hartford and Holyoke is 34 miles long, and, in the several reports, is divided into three distinct sections. From Hartford to the foot of Enfield Rapids, 10½ miles, the river has a gentle slope, with a sandy, shifty bottom; from the foot to the head of Enfield Rapids, 5½ miles, the total fall at low water is 32 feet, and the bed of the river is largely rock; from Enfield Falls to Holyoke, 18 miles, the river is of moderate width, gentle slope, fair depth and stable bottom.

In its original condition the lower section had a navigable depth of 2 feet or less at low water; the second section could be navigated upstream only with great difficulty, and only by boats of shallow draft; the third section was navigable by boats drawing 4 to 5 feet of water.

There exists at Enfield Rapids, in the State of Connecticut, a canal with locks 80 feet in length and 18 feet in width, designed for boats with draft of about 3 feet at low water, which was constructed about 1830 by the Connecticut River Company as part of a water-power development scheme, under charter from the State of Connecticut. In

1897 the government engineers reported that the work was in a fairly serviceable condition, and that the company's canal was navigable to the extent of its dimensions, but added: —

> Such boating as these dimensions permit is not navigation in the present significance of the word, and no feasible alterations of the company's canal will make it so.

When the dam was built an opening 150 feet wide was left in the middle of the structure, but this opening has been much obstructed, and no provision made for the passage of boats or fish. As a result of work done on this dam between 1854 and 1897, extreme low water at Springfield was apparently raised about 2 feet. By means of this canal and the part of the river below and the pool above, navigation was carried on between Hartford and Holyoke up to about 1877, at which period competitive rates could no longer be made by vessels small enough to pass the locks of the canal. The canal, however, has remained nominally open to navigation.

Before the report of Major Leach, in 1897, a plan based on surveys made between 1871 and 1874 had been formulated for building a lateral canal on the east bank of the river, for passing the rapids at Enfield, to be carried out in connection with work in progress lower down the river. This lateral canal was planned for a width of 150 feet, a depth of 10 feet in the trunk, with locks 200 feet long, 55 feet wide and 8 feet deep on the sills, the estimated cost being $2,306,345, which was subsequently reduced to $1,322,805, based on a modified plan providing for a width of 120 feet in the trunk. The canal was to be about 16 miles long. Major Leach speaks of this lateral canal and of plans for improvement of the river in his report of 1897 as follows: —

> A careful study of the subject justifies the statement that this canal, though in some respects unsatisfactory, represented the best solution then possible of the problem of providing a secure and commodious water route from Hartford to Holyoke. That a solution possessing all the advantages of that one and obviating most of its defects, can now be offered is due solely to the advance in the science of river engineering. . . . A water route to make its influence felt as a factor in transportation must permit extension to Springfield and Holyoke of the present traffic below Hartford. This criterion demands a depth of 9 feet at extreme low water, a channel width of not less than 150 feet at the same stage, and no obstacles to the passage of the largest vessels now navigating the lower Connecticut River.

The plan presented by Major Leach for the improvement of this stretch of river provided for the construction of three locks and dams, the dams to be movable and of the Chanoine wicket type, and for excavating, where required, to make a channel 150 feet wide and 9 feet deep below pool level. The dams were to be built as follows: —

The upper one was to be in the east branch of the river at King's Island, the west branch to be closed by a fixed dam. This location was 20.85 miles from Holyoke and 3½ miles below the present Enfield dam. The second dam was to be 22 miles from Holyoke and the third dam just below the highway bridge at Hartford. The ruling dimensions provisionally adopted as a basis of estimate were for locks 260 feet working length, 45 feet width and 10 feet depth on the sills. The estimated cost of this project was $2,075,000, and the estimated cost of maintenance, operation, etc., approximately $8,000 per annum.

Major Leach expressed the opinion in his report that this part of the river was worthy of improvement by the general government in the manner and to the extent set forth therein, but his plan was not adopted.

The next proceeding by the government was under the provisions of the river and harbor act of June 13, 1902, which provided for the appointment of a board of three officers of the engineer corps to make an examination of the plan prepared by Major Leach, and to report thereon.

This special board caused another survey of the river between Hartford and Holyoke to be made under its direction, and reported under date of Aug. 11, 1904. Its opinion was that locks should be made 60 feet wide, instead of 45 feet, as recommended by Major Leach, so as to take in four coal barges of the size used along the coast; it was stated, also, that the plan proposed by this officer would cost, at prices then current, $3,700,000, with an annual maintenance charge of $50,000. This special Board proposed three plans. The first involved three fixed dams with locks, the lowest of the series to be located somewhat further upstream than that recommended by Major Leach; for this plan the total cost of construction was estimated at $2,725,000. The second plan involved two locks with fixed dams, the lowest one to be at Warehouse Point, and the channel from there to Hartford to be excavated mechanically. The cost of construction of this second project was estimated at $2,621,000. The third method involved a lock and fixed dam near Hartford, and proposed to make use of the upper part of the Windsor Locks canal, with a second lock to overcome the difference between the canal level and that of the pool created by the lock and dam at Hartford. The cost of construction for this method was estimated at $2,393,500. The annual maintenance charge for any one of these three plans was estimated to be about $40,000. These estimates of the special Board did not include damages to the Connecticut River Company, which owned the Windsor Locks canal, and certain water rights which might be affected by the proposed improvement; nor did they include any expenses for altering the bridges then spanning the Connecticut

River, which it was stated would have to be changed were the project adopted.

This special Board expressed the opinion that the Connecticut River Company, under charter from the State of Connecticut, had created certain water powers, and extensive industries partly dependent thereon, and certain facilities for navigation which were insufficient for needs of general commerce, and that the value of the company's plant at Windsor Locks would be impaired to some degree by any adequate improvement of the river. It suggested that damage to the company through taking away its right to charge tolls should be adjusted on the basis of the company's average receipts from that source for the last twenty years for boats which could pass through the locks. It considered that the company had a right to an equitable allowance for impairment of existing water power, but not for damages to undeveloped water power, and believed that the amount of such damages should be fixed by the courts after the improvement had been made. This special Board did not attempt to estimate the amount of these damages, and did not express any opinion as to whether or not it was desirable that the government should undertake this improvement.

The report of this special Board was submitted to the Board of Engineers for Rivers and Harbors, and in its report, under date of Dec. 23, 1904, it was stated that the estimates of cost submitted by the special Board were not too large, and that the depth of 9 feet was the minimum that should be considered in any plan providing for future navigation. The concluding portion of this report is as follows: —

At an assumed first cost of $3,000,000, the annual interest charge at 3 per cent would be $90,000. Adding to this the sum of $50,000 for maintenance, and assuming the annual tonnage that would avail itself of the new waterway at 500,000, it is seen that the cost to the Government would be 28 cents per ton. In this estimate no account is taken of the amount that the United States might be compelled to pay for damage to existing water power nor the cost to the people and States for the modification of existing bridges.

Owing to the large cost as compared with the probable benefits and the insufficient depth of water in the channel below Hartford, the Board is of the opinion that the proposed improvement of the Connecticut River between Hartford and Holyoke is not worthy of being undertaken by the General Government.

Under date of Dec. 18, 1906, the Chief of Engineers submitted to the Secretary of War a report of Dec. 7, 1905, by a Board of Officers, Corps of Engineers, authorized by the following provision in the river and harbor act of March 3, 1905: —

Connecticut River between Hartford, Connecticut, and Holyoke, Massachusetts: The Secretary of War is authorized and directed to reconvene

the Board of Engineer Officers heretofore designated under provision of the river and harbor act approved June thirteenth, nineteen hundred and two, and which board reported upon said improvement in a report dated August eleventh, nineteen hundred and four, for the purpose of preparing and submitting an additional report on the improvement of said river by open-channel work or methods other than those already reported upon.

In its report this special Board presented several plans and estimates for certain forms of improvement, but, for reasons given, concluded that the river between Hartford and Holyoke was not worthy of improvement by the United States. This report was referred to the Board of Engineers for Rivers and Harbors for review and recommendation.

Under date of Dec. 8, 1906, the Board of Engineers for Rivers and Harbors reported recommending that the improvement of the river be authorized in accordance with a given plan suggested by the special Board, provided that all private rights claimed to be infringed by this work should be ceded to the United States without cost.

The Chief of Engineers stated that the improvement desired was entirely feasible from an engineering standpoint, and the advisability of undertaking the work must be decided from the advantages derived. When the extensive private corporate rights that will be affected by any permanent works have been ceded to the United States without cost, there may be justification for the proposed improvement.

The Board of Engineers for Rivers and Harbors stated that in its opinion the third method of improvement suggested by the special Board, namely, by dredging and the use of wing dams and training walls and rock excavations to a point above the mills at Windsor Locks, thence by a new lock and the upper portion of the existing canal, at a cost of $1,465,600, was justified by the present and prospective commerce of the river.

The river and harbor act of March 2, 1907, contained the following item: —

Improving Connecticut River between Hartford, Connecticut, and Holyoke, Massachusetts: For investigation and further examination, as recommended by the Board of Engineers in report submitted in House Document Numbered Three hundred and twenty-three, Fifty-ninth Congress, second session, five thousand dollars.

In the report referred to in the above item the Board of Engineers for Rivers and Harbors recommended the improvement of the river between Hartford and Holyoke, under a plan involving an expenditure of $1,465,600, with the provision that all rights claimed to be infringed by the work should be ceded to the United States without cost. The rights referred to were those claimed by the Connecticut River Company.

In a communication to the Secretary of War, Jan. 6, 1909, transmitting a report of Maj. Harry Taylor, Corps of Engineers, dated Oct. 31, 1908, the Chief of Engineers stated: —

For several years there has been under consideration a project, not yet adopted, for continuing the improvement of the Connecticut River above Hartford, Connecticut, to the city of Holyoke, Massachusetts. In a report published in House Document No. 323, Fifty-ninth Congress, second session, the Board of Engineers for Rivers and Harbors recommended for adoption a plan of improvement which involved the joint use by the United States and the parties controlling the same of the upper portion of an existing canal around Enfield Falls, this recommendation being subject to the proviso that all rights claimed to be infringed by the work to be done by the United States should be ceded to the Government without cost.

It is understood that the further examination contemplated by the item of the act quoted above has for its object to ascertain whether the rights which might be infringed by the work recommended by the Board of Engineers for Rivers and Harbors would be ceded without cost to the United States by the private interests affected.

To the date of his report, October 31, 1908, Major Taylor states that he has been unable to obtain a definite answer to his inquiries on this subject from the Connecticut River Company, which claims to control the rights referred to. In a separate paper submitted to the Board of Engineers for Rivers and Harbors under date of December 7, 1908, the Connecticut River Company formally declines to cede said rights to the United States without cost. In view of this decision on the part of the company the Board states in its report of December 21, 1908, that the plan of improvement previously recommended by it with the restricting proviso is impracticable of fulfillment, and adds that should Congress decide to undertake this improvement at the cost necessarily involved it is possible that some other plan incurring about the same expenditure might be found to be preferable.

Major Taylor's report, referred to above, contains much valuable information, and the following extracts therefrom are interesting as showing the necessity for opening this river to navigation as far as Holyoke: —

In the course of the study of this matter two points have been brought to my attention to which it seems proper to refer. These are, first, the need of the improvement, and second, its cost. All previous reports have, I believe, been based on the idea that the improvement of this section of the river has been asked for mainly, if not entirely, as a means of regulating the freight rates over the railroads to the cities of Springfield, Holyoke, and vicinity, and not with any real expectation that any great amount of commerce would be carried on the river, although in all of the reports there have appeared statistics, given by interested parties, showing the probable amount of commerce which would be developed if the im-

provement was made. While it is probably a fact that the main object of the improvement in past years has been a means of regulating the freight rates, nevertheless the conditions that arose during the year 1907 showed the great value that those improvements would have in the commerce carried. During that year this section was not exempt from the congestion of the railroad traffic that was so general throughout the United States, and during the summer of 1907 it was not a question of rates, but it was a question of getting freight at any price to Springfield and Holyoke.

In the matter of coal I have been informed that the supply ran so low that the company which supplies gas to Springfield was compelled to obtain its fuel for daily use in the local market at retail prices wherever it was practicable to obtain it, and that it more than once appeared that the company might be obliged to practically cease operations on account of lack of fuel. If the river had been open to navigation, there can be no question but what coal would have been brought up in considerable amounts during that summer and the relief from the uncertainty would have been of tremendous value. Other commodities were delayed in transit days and sometimes weeks between Springfield and Holyoke and New York, to the great inconvenience and loss of the merchants and manufacturers. Such a condition could not have existed had navigation of the river been possible. It is possible that the condition which arose during that year may arise at any time in the future, and in view of this condition the importance of the improvement of this section of the river has taken an entirely different aspect from what it had before.

As to the cost, the improvement recommended by the last Board and approved by the Board of Engineers for Rivers and Harbors, provided its cost did not exceed $1,465,600, is limited to the river below Windsor Locks and to a lock of suitable size for permitting entrance into the canal of the Connecticut River Company above the mills at Windsor Locks. (Published in House Document No. 323, 59th Congress, 2d sess.).

All previous plans have provided for additional improvements above the point where this plan stops. This plan, which was submitted in compliance with the act of March 3, 1905, which called for an additional report on the improvement of said river by open-channel work or methods other than those already reported on, requires the utilization of the canal of the Connecticut River Company from the new lock to be built by the United States to its upper end, the use of the existing guard lock, and depends upon the dam now built to form the upper pool. I understand that the idea of the Board was that this would afford sufficient facilities for commerce to form an indication as to whether future improvements in the way of enlarging the canal or other improvements above the point at which the present plan stops would be justified, and if such further improvements appeared justified by the development of commerce that they could be provided for by an extension of the project.

I am unable to see how this plan would afford sufficient facilities to give any such indication and I believe that the entire project, including the enlargement of the canal and repair or reconstruction of the dam or otherwise providing for the improvement of the upper part of this reach should be entered upon or else nothing done, as the canal is of such small

cross section that when the mills are running the current in it is so swift that it would be impracticable for a boat of any size to navigate it safely, and the lock at the upper end of the canal being of the same size as the locks at the lower end, improving the lower river and building a large lock for entrance into the canal does not improve present conditions unless proper provision is made for boats to get through and out of the canal.

In reference to barges in successful use on this river below Hartford, Major Taylor says: —

This type of barge would most likely be used in the traffic of the section of river between Hartford and Holyoke if it were practicable to use it, the economical use indicating the loading of the barge to its full capacity and bringing it as far as Hartford, then taking out sufficient of its cargo to reduce its draft enough to permit it to be taken on to Springfield or Holyoke. These barges carry approximately 1000 tons on a 10-foot draft and approximately 500 tons on a 7-foot draft. A draft of 10 feet can at all ordinary stages be readily carried to Hartford, and as the project for the improvement of the river above Hartford provides for a 7-foot depth the drafts above stated would appear to be those that would be ordinarily used and would indicate the most economical transportation of coal to Hartford, Springfield, and Holyoke.

Under date of March 24, 1910, the Acting Chief of Engineers submitted to the Secretary of War reports dated May 19, 1909, and Jan. 29, 1910, with maps, by Lieut. Col. Harry Taylor, Corps of Engineers, on preliminary examination and survey, respectively, required by the river and harbor act of March 3, 1909, of that part of the river between Hartford and Holyoke; also a supplemental report, dated Jan. 3, 1910, by this officer, regarding terminal facilities, etc. In this connection the Acting Chief of Engineers reported: —

Plans were prepared by a Board of Engineers under authority of the river and harbor act of March 3, 1905, which were deemed practicable and feasible, but the cooperation of the water power interests necessary to carry them into effect has not yet been secured and no appropriations have been made by Congress.

Some improvements have been carried on by the General Government below Enfield Rapids by dredging and constructing wing dams, but no work has been done since 1886. The pool above the present dam affords a navigable depth of 7 feet to Springfield, and as this appears the logical depth to be sought below the dam former estimates, based upon detailed surveys, have been prepared and are now repeated for a channel 7 feet deep and 100 feet wide from Hartford to Windsor Locks, at an estimated cost of $1,015,600, with $10,000 annually for maintenance. The district officer believes that this large expenditure is not justified, but in order to determine what use would be made of the river if improved, he recommends a channel 100 feet wide and 5 feet deep, with a lock 160 feet in

usable length, 40 feet in width, and 8 feet in depth, at an estimated cost of $800,000, with $8,000 annually for maintenance; and he states further that if a lock of these dimensions is constructed in connection with the 5-foot channel it will be practicable to deepen the channel so as to provide a 7-foot draft to Springfield and Holyoke if, in the future, it is demonstrated that a greater depth is necessary. The division engineer submits views in concurrence with those of the district officer and with remarks as to the advisability of building a lock of dimensions capable of use by boats built for use on the New York State barge canal.

These reports have been considered by the Board of Engineers for Rivers and Harbors, and in report dated March 14, 1910, the Board states that a channel depth of 5 feet is not sufficient, and recommends the adoption of the plan presented in House Document No. 323, Fifty-ninth Congress, second session, contemplating a depth of 7 feet and a width of 100 feet, involving dredging, rock excavation, and the use of wing dams and training walls, at an estimate cost of $1,015,600, with $10,000 annually for maintenance, under the following conditions:

1. That a suitable lock and dam for surmounting the Enfield Rapids be constructed by private or corporate interests, free of cost to the United States.

2. That navigation through said lock shall be free from any toll or charge.

3. That those constructing the lock and dam assume all responsibility for damages that may arise from flowage rights, from injury to water power, or from any other source.

4. That after construction the lock shall become the property of the United States, and shall be maintained and operated at the expense of the Federal Government.

Two companies now seek the privilege of developing water power — the Connecticut River Company, controlling the existing water power development, and the Northern Connecticut Power Company, a new corporation — and bills are now before Congress (S. 5594 and S. 2761) for the authorization of water power development by each company at the same locality. The former submits two plans, each involving the use of one lock, the one with the dam below the bridge being deemed preferable by the district officer. It appears from an examination of the plans presented, that either the plan of the Northern Connecticut Power Company, or the Connecticut River Company's plan, with the dam below the railroad bridge would, with a suitable lock, meet the demands of navigation. The Board states further that any general plans would require some modifications, and that any bill authorizing the construction of water power development in connection with navigation should be elastic in this respect, and should contain the proviso that detailed plans should be subject to the approval of the Chief of Engineers and the Secretary of War; also that such legislation should contain unusually strict conditions guaranteeing prompt commencement, prosecution, and completion of the work, and that the work to be done by the United States be not undertaken until sufficient work on the lock and dam is done to give reasonable assurance of its satisfactory completion.

Concurring in the views of the Board of Engineers for Rivers and Harbors, it is recommended that the improvement of the Connecticut River be undertaken by the United States at an estimated cost of $1,015,600 under the conditions specified by the Board. Any provision made for the improvement should specifically require that no part of any funds appropriated should be expended and no contract authorized should be entered into by the Secretary of War until satisfactory provision for the prompt completion of the improvement of the section over Enfield Rapids in accordance with the conditions specified by the Board of Engineers for Rivers and Harbors has been made by private, corporate, or other local interests, nor until actual work upon the improvement of this section has been actively undertaken.

In view of the vested interests acquired under state law and the legal complications attendant upon any development of water power at Enfield Rapids by the United States in connection with improvement for navigation, it is not considered advisable for the United States to attempt to develop the water power, or to cooporate with private interests to any greater extent than above recommended.

Attention is invited to the statement of the Board that since no policy has been adopted by Congress as to time limits and charges for water power privileges in cases like this one, the Board confines itself to calling attention to the fact that these matters are not covered in the above recommendation.

The district officer in his report of May 19, 1909, above referred to, stated: —

While a plan for the improvement of this river might be devised which would differ in some minor details from any plan which has heretofore been reported, the essential features which must be part of any plan have all been fully considered and reported upon. No satisfactory plan for the improvement of this section of the river has been devised which places the cost at much less than $2,500,000, and this is approximately the cost of any plan which might be devised. On account of the character of the improvement to be made, very little benefit will result until the whole improvement is completed; consequently the work should not be entered upon unless it is intended to carry it through to completion and that as rapidly as possible. Otherwise, money spent on it will be largely wasted.

The key to the situation is held by the Connecticut River Company, which, under its charter, has developed the Enfield Rapids for water power purposes and has incidentally provided a small and inadequate canal for navigation. The present attitude of this company is that it will not permit the United States to improve the river for navigation without payment of excessive damages for infringement of rights which it claims. I understand also that this company declines to consider any proposition from other private companies for the sale of its privileges. So long as the Connecticut River Company maintains its present attitude and is allowed to block the entire river, which it is doing at the present time, it does not appear that any improvement of the river will be possible.

This section of the Connecticut River could be improved not only without detriment to the water power which is now developed, but the improvement could be so made as to materially increase the available water power and at the same time provide ample facilities for navigation. At least two schemes to my positive knowledge have been developed by private parties, who claim that they would be willing to spend a large amount of money in the development of this water power and provide ample facilities for navigation if a satisfactory deal could be made with the Connecticut River Company. One of these schemes went as far as the introduction in Congress of a bill authorizing the necessary work. (H. R. 21731, 60th Cong.) . . .

No special terminal or transfer facilities at Springfield or Holyoke have been provided up to the present time, as there is no occasion for such facilities. There is ample area, however, for the establishment of such facilities whenever there is any navigation which would warrant them.

The district officer in his report of Jan. 3, 1910, above referred to, stated: —

There are no wharves either public or private in either Springfield or Holyoke. The park commissioners of the city of Springfield are preparing to build a wharf this spring which will be open to all parties, and which will be ample for pleasure service by the boats which now exist on the river. It is understood also that some arrangements by which freight can be unloaded will be made, but just what these arrangements will be is not known at the present time.

At Holyoke there is a considerable extent of unoccupied water front where wharves could be built if there was any demand for them. At Springfield there is also ample room for the development of wharves, and the New York, New Haven and Hartford Railroad Company runs for a distance of about 2 miles within 200 feet or less of the high water mark so that connections between wharves and this railroad could easily be made, and from this road connection to the Boston and Albany and the Boston and Maine Railroads could be made by transfer. (See House Document No. 231, 58th Congress, 3d session, pl. 12, sheet 5.)

There has, however, been on foot for some time a movement in Springfield to have the New York, New Haven and Hartford Railroad transferred to the west side of the river and to convert the entire city water front into a park. Should this be accomplished it would practically withdraw the Springfield water front from commercial development and limit the development of wharves to the west side of the river. This would place the wharves so far from the business center of the city as to put a serious handicap on, if not to entirely prevent the development of a local river commerce, even if there were suitable facilities for navigation provided between Springfield and Hartford.

The district officer in his report of Jan. 29, 1910, above referred to, stated: —

Above the Enfield dam there is already existing a channel of 7 feet or more to Springfield, and it is not necessary to do any additional work on

that stretch of the river to provide for a 7-foot navigation, although if a large amount of commerce should be carried it would probably be advisable to straighten the channel in some places. This, however, has no effect upon the development of water power.

Up to June 30, 1912, there was no adopted project for the improvement of this river between Hartford and Holyoke. From a point a short distance above the railroad bridge at Hartford to the lower lock in the canal at Windsor Locks there is an available depth for navigation of about 5 feet, although at extreme low-water periods there is less depth. From the upper end of the canal to the head of navigation at Holyoke there is substantially a depth of 7 feet. Accurate conditions will be known after the completion of the survey of the river authorized by the last river and harbor act. The total appropriations for this section of the river from July 11, 1870, to July 25, 1912, inclusive, were $155,000.

The total expenditures for the improvement of the Connecticut River by the federal government, to the close of the fiscal year ended June 30, 1911, were $703,721.91, as stated in Senate Document No. 382, 62d Congress, 2d session.

A statement of the present situation at Windsor Locks, and proceedings before Congress relative to a bill to authorize the construction of a dam at that point, may be found on pages 45–54 of this report.

Investigations, Reports, Appropriations and Expenditures by the Commonwealth of Massachusetts.

The total length of the Connecticut River within the State of Massachusetts, measured as the river flows, is 66.57 miles, of which 50.7 miles is above the Holyoke dam and 15.87 miles below this dam.

The following table shows the distances between various points along the entire length of the river in Massachusetts and Connecticut, beginning opposite the light at the outer end of the west jetty at the mouth of the river at Saybrook: —

	Miles.
Light at west jetty, Saybrook, Conn.,	0.0
Railroad bridge at Connecticut River station,	3.31
Lyme and Saybrook bridge,	3.95

	Miles.
East Haddam bridge,	15.47
Railroad bridge at Middletown,	29.99
Highway bridge at Middletown,	30.18
Highway bridge at Hartford,	48.39
Railroad bridge at Hartford,	49.08
Bridge at Windsor Locks,	60.13
Railroad bridge above Windsor Locks,	61.24
Bridge below Enfield dam,	63.48
Enfield dam,	64.46
Thompsonville bridge,	65.18
Massachusetts–Connecticut line,	66.83
South End bridge, Springfield,	71.28
Old toll bridge,	72.63
Boston & Albany Railroad bridge,	72.82
North End bridge,	73.71
Chicopee bridge,	76.33
Willimansett bridge,	80.78
Boston & Maine Railroad bridge,	80.81
South Hadley bridge,	82.32
Holyoke dam,	82.70
Northampton bridge,	93.88
Railroad bridge at Northampton,	93.91
Sunderland bridge,	106.69
Boston & Maine Railroad bridge at East Deerfield,	113.95
New York, New Haven & Hartford Railroad bridge at Montague City,	115.59
Montague City bridge,	115.97
White suspension bridge,	118.51
Dam at Turners Falls,	119.16
Red suspension bridge,	119.41
Mount Hermon bridge,	130.14
Central Vermont railroad bridge, Northfield,	131.85
Schell Memorial bridge, Northfield,	132.39
Massachusetts–New Hampshire–Vermont line,	133.40

Nineteen cities and towns bordering on this river in Massachusetts have a total frontage thereon of 134.05 miles, of which about 14,875 feet, or 2.82 miles, are owned or controlled by the municipalities, and 24,274 feet, or 4.59 miles, by railroad companies.

A table giving detailed information follows: —

Ownership or Control.

Town or City.	By Municipality (Feet).	By Railroads (Feet).	Private (Feet).	Total (Feet).	Total Frontage (Miles).
Agawam,	–	–	24,583	24,583	4.65
West Springfield,	3,680	900	26,670	31,250	5.90
Longmeadow,	–	–	17,916	17,916	3.39
Springfield,	1,800	14,609	8,174	24,583	4.65
Chicopee,	55	3,925	33,520	37,500	7.10
Holyoke,	2,060	–	56,440	58,500	11.08
South Hadley,	Ferry landing	–	34,833	34,833	6.59
Easthampton,	–	–	1,666	1,666	.31
Northampton,	1,900	3,000	30,933	35,833	6.78
Hadley,	Ferry landing	–	80,833	80,833	15.30
Hatfield,	Ferry landing	–	41,250	41,250	7.80
Whately,	–	–	16,250	16,250	3.08
Sunderland,	Ferry landing	–	34,166	34,166	6.46
Deerfield,	Ferry landings	–	48,750	48,750	9.22
Greenfield,	5,280	–	12,636	17,916	3.39
Montague,	–	1,840	68,992	70,832	13.40
Erving,	–	–	2,918	2,918	.55
Gill,	Ferry landings	–	53,750	53,750	10.18
Northfield,	100	–	75,016	75,016	14.22
Total for 19 cities and towns,	14,875±	24,274	669,296	708,445	134.05

Mr. Clemens Herschel, at that time hydraulic engineer for the Holyoke Water Power Company, stated in a paper prepared for the Harbor and Land Commissioners in 1884 that in a length of about 59 miles, in Massachusetts, the river had a fall of about 155 feet.

The river from Willimansett bridge at Holyoke to the boundary line between Massachusetts and Connecticut, and extending to the Enfield dam in Connecticut, was a mill pond about 16 miles long, formed by this dam. Rapids, covering a fall of about 27 feet, existed from Willimansett bridge upstream to the foot of the Holyoke dam, the fall at this dam being about 30 feet.

Below Smith's Ferry, about halfway between Northampton and Holyoke, were rapids; and rapids and a dam at Turners Falls, 36½ miles from the Holyoke dam, covered a fall of some 66 feet in all. Above Turners Falls the mill pond extended some 4 or 5 miles upstream to the junction with Millers River; then came rapids of some 10-feet fall. The river left the State at its northern boundary at an elevation of about 195 feet above the mean level of the sea.

Topographical surveys from a point about 1 mile below the Holyoke dam to the northerly boundary line of Massachusetts have been made under the direction of the Board of Harbor and Land Commissioners, and maps prepared showing the river lines, various bridges and other structures, and the topographical features along the banks. These data have been used in preparing the maps accompanying this report. Owing to lack of funds the Connecticut Valley Waterway Board has been unable to supplement this work by making soundings in this part of the river and procuring other data necessary to the preparation of any project for future improvement for purposes of general navigation. For the same reason no surveys could be made of other parts of the river.

From inquiry, and from information furnished by F. W. Carrier who has navigated this river for many years and is familiar with the subject, it appears that conditions in respect to depths of water as far as Turners Falls are substantially as follows: —

From a point at the rapids 2 miles above the Holyoke dam to Mount Tom station there is always a depth of not less than 6 feet.

From Mount Tom station to Shepards Island, during periods of normal water level, there is from 3.8 feet to 6 feet.

From Shepards Island to a point ½ mile above the Horseshoe, commonly called Bowman's Pool, 2 miles above Northampton bridge, there is always a depth of from 4 feet to 40 feet.

From Bowman's Pool to the head of the riprapping at Hadley there is a depth of from 3 feet to 8 feet during periods of normal water level.

From the riprapping to the cable crossing, or the old ferry road, during periods of normal water level there is not more than 3 feet.

From the cable crossing to Indian Hill, or Ryan's Gravel, there is always 8 feet or a little more.

From Ryan's Gravel to the Hadley–Sunderland line there is a depth of 2½ feet at periods of normal water level.

From the Hadley–Sunderland line to the southerly end of the second island above Sunderland bridge there is always at least 4 feet.

From this last point to Whitmore's Ferry, with the exception of a short stretch at the head of this island, there is a depth of 3 to 4 feet, or more, at periods of normal water level.

From Whitmore's Ferry to a point opposite the southerly end of an island, just south of the mouth of Sawmill River, there is a depth of from 8 to 10 feet at all times.

From the last-named point for a distance of about 6,700 feet there are shifting sands, rocks and snags, and the river is in general full of shoals.

From the last-named point to the Boston & Maine Railroad bridge, Fitchburg division, at East Deerfield, there is a depth of from 5 to 10 feet.

From this bridge to the south end of an island, about 4,300 feet, there is, at periods of normal water level, a depth of 3½ feet, there being at the southerly end of this island a large number of rocks extending across the river.

From this last-named point to a point 600 feet below the New York, New Haven & Hartford Railroad bridge at Montague City there is from 4 to 10 feet, and below this bridge are a large number of rocks extending nearly across the river.

From this last point to the junction of the Connecticut and Deerfield rivers, and as far north as Montague City bridge, there is a depth of from 10 to 30 feet.

From Montague City bridge to Turners Falls dam the depth of water varies, but the character of the river bottom is ledge practically all the way.

Above Turners Falls, for a distance of about 4.34 miles to the French King Rapids, there is much use made of the river

by motor boats for pleasure purposes, and there is apparently a good depth of water, excepting at the "Horse Race," which is obstructed by outcropping ledge.

Although the State of Massachusetts has made no expenditure directly with a view to increasing the depth of water and improving the facilities for water carriage, yet, beginning in the year 1888, the Commonwealth has built protective works along the river banks at Hadley, Hatfield, Agawam, Northampton and West Springfield, for which $103,508.17 was expended. The total expenditure to Dec. 1, 1912, is $106,296.18.

By chapter 58 of the Resolves of 1884 the Board of Harbor and Land Commissioners was authorized "to examine the channel and course of the Connecticut River within the confines of this Commonwealth, and to investigate the cause and effects of floods upon the same, and to report to the next General Court the necessity or expediency of any legislation for the preservation and improvement of said river, and for the promotion of all interests connected therewith."

The principal facts and suggestions submitted at public hearings given by the Board in pursuance of this resolve were as follows: —

1. That the channels, banks and course of the river are continually changing, in some places rapidly, and to the serious detriment of public as well as private interests. No accurate record of these changes exists, and the observation or memory of individuals in regard to them is conflicting and unreliable.

2. That artificial structures have been built from time to time in or across the river for business uses, and may be required in the future, especially by the lumbering interest; and that, while there is no feeling of hostility towards this or any other interest using the river, but, on the contrary, a disposition to allow every necessary and reasonable facility in its use, there is some apprehension in regard to the actual or probable effect of some of these structures upon other interests, public or private, and a feeling that the location, mode of construction and maintenance of all artificial structures within the bed and banks of the river should be subject to some system of public regulation and control analogous to that which supervises the building of railroads or the erection of structures in tide waters.

3. That there has never been any uniform plan or system governing

the construction of the various improvements, defensive works, dikes or levees, breakwaters, booms, piers, etc., in or adjacent to the river, with reference to their influence upon the flow of the river and its action upon its bed and banks; that the attempts to restrain the ravages of the river by protecting works have, with few exceptions, been disjointed, ill-advised and unsuccessful; and that an approved general system, based upon principles and rules which are the result of scientific investigation and study, is needed to guide the construction and prevent the injurious effects of all such structures and works, and to secure the concerted and successful action of all the different interests for their common benefit and protection.

4. That the floods to which the river is subject expose a large territory and large interests to serious damage; that many observers believe that the currents of the river, by reason of the increase of artificial obstructions, or from other causes, do not remove deposits as rapidly as formerly, and that the channels are "silting up," the bed becoming higher and more shallow, and the dangers from floods in consequence aggravated; that long and severe droughts are also a source of much inconvenience and loss; and that the subject of the control of floods and droughts by storage basins or otherwise is now receiving much attention in this and other countries, and is deserving of careful consideration and study in connection with this river.

5. That, within a comparatively recent period, large manufacturing interests have grown up at different points upon the river; that the dams of the water-power companies, and the booms and piers of the lumber companies, and the storage of logs, have altered the natural flow and habit of the river, and are tending to change its whole régime; and that these changes and their effects should be carefully observed and noted, so that injurious results may be seasonably averted.

6. That sufficient data do not now exist for prescribing the best methods for the preservation and improvement of the river, and for "the promotion of all interests connected therewith;" that, as the first step towards determining a proper system of treatment, whether in general or in detail, a survey and plan of all that portion of the river within the Commonwealth should be made, accurate levels established at points along its banks, sufficient soundings taken to determine the location and depths of its channels, and such other physical facts and features noted as would enable competent experts to study and prescribe the best general system of treatment, and to solve such practical questions as might from time to time arise; and that daily observations of the heights of the water at selected points should also be taken and recorded.

The word "conservation" was not very generally used twenty-five years ago, yet Massachusetts used and applied it to this river in chapter 344 of the Acts of 1885, entitled "An Act

in relation to the Conservation of the Connecticut River." This act conferred upon the Board of Harbor and Land Commissioners the general care and supervision of this river within the confines of the Commonwealth, and of the banks thereof, and of all structures therein "in order to prevent and remove unauthorized encroachments and causes of every kind, which may in any way injure the said river, and in order to protect and develop the rights and property of the public therein."

Other parts of this act provide for the approval by the Board of plans of certain structures in the river; the licensing of wharves, piers, etc.; the surveying and plotting, as soon as funds should be provided therefor, on such scales as they shall determine, the whole of the river within the Commonwealth, the records and maps of the same to be preserved in the office of the Board; the preparation for the counties of Hampden, Hampshire and Franklin of a copy of the survey or map of the river. The effect of this act was to give the Board jurisdiction over this river, within the confines of the State, similar to that which it then had over tide waters.

An appropriation of $1,000, made in 1896, for beginning surveys of the river as contemplated in the act of 1885, is the only direct appropriation for this purpose which has been made. Under this appropriation about 6½ miles of the river were surveyed, based on the triangulation done under the direction of the Topographical Survey Commission, whose powers and duties were transferred to the Harbor and Land Commissioners in 1901.

On Feb. 6, 1896, the Massachusetts Legislature adopted resolutions relative to the navigation of this river, urging the need of opening it to navigation as far as Springfield and Holyoke.

By chapter 82 of the Resolves of 1897 the Board of Harbor and Land Commissioners was "authorized to inquire into the advantages which would accrue to this Commonwealth by the improvement of the navigation of the Connecticut River as far as the cities of Springfield and Holyoke."

Under authority of this resolve an exhaustive study of this matter was made, and a report to the Legislature submitted under date of January, 1898 (House Document No. 907, 1898). The conclusions of the Board were: —

1. That transportation by water should be established immediately as far up the river as Holyoke.

2. That the prosperity of Massachusetts depends upon the encouragement of manufacturing in the interior, and the development of commerce at the seaboard.

3. That conditions here are favorable for the payment of high wages and production at low cost, and the tendency of these conditions would be elevating among the class of citizens who supply the skilled labor.

4. That low cost of transportation for raw material and fuel to the manufacturing centers and for the finished product to the markets are essential to success in competition.

5. That the opening of water carriage to railway centers insures low freights.

6. That the beneficial influence of the direct advantages would extend broadly in many directions, while the indirect influences would be too diversified and numerous to set forth, and yet would pervade the whole Commonwealth.

7. That no reason exists which would justify Congress in denying to the inhabitants of the Connecticut valley the benefits to be derived from improving the river navigation as desired, in accordance with the policy of internal river improvements, now settled for more than seventy years and generously applied in other portions of the country.

It may be well to call attention here to the fact that twenty-five years ago not only were the cities and towns in this valley, and the State as well, in accord with the movement for an improved waterway to Springfield and Holyoke, but Major Leach of the Engineer Corps had at that time submitted to the Chief of Engineers a report and plan favorable to such a project, as appears on pages 11 and 12 herein.

Certain other important legislation concerning the Connecticut River, passed by the Massachusetts Legislature, is noted in the following paragraphs: —

Chapter 266 of the Acts of 1891 provided that all work done in or within the banks of this river below high-water mark, without authority from the Legislature or the Board of Harbor and Land Commissioners, or in a manner not sanctioned by said Board when its license or approval is required, should be deemed a public nuisance and liable to indictment as such; and said Board was authorized to order suits on behalf of the Com-

monwealth to prevent or stop any such nuisance, by injunction or otherwise. It is further provided that nothing in this act should be construed as legalizing any structure, filling or other encroachment below high-water mark on said river, heretofore made or done without due authority of law, or as waiving or impairing any rights or remedies of the Commonwealth or of any person in respect thereto.

By chapter 301 of the Acts of 1893 a river line was established along the banks of the river at Springfield to limit the extension of wharves, piers, walls, and filling or other structures, excepting that the city of Springfield might, upon license from the Harbor and Land Commissioners, extend sewer outfalls beyond this line.

By chapter 104 of the Resolves of 1898, $2,000 was appropriated for the purpose of securing favorable consideration by Congress of the opening of the river to navigation, to be expended under the direction of the Governor and Council to meet the necessary expenses of the Harbor and Land Commissioners in appearing before the proper committees of Congress to present the advantages that would accrue to the Commonwealth by the restoration of such navigation.

Chapter 115 of the Resolves of 1907 authorized the Board of Harbor and Land Commissioners to dredge a channel 6 feet deep at low water in the Connecticut River in the city of Holyoke, and authorized the expenditure of not exceeding $15,000 for this purpose. A provision in this resolve was that no part of said sum should be expended until the United States had begun to improve the channel and locks in said river in order that vessels with a draft of not less than 6 feet might freely pass from the sea to the entrance of said proposed channel near Willimansett bridge. No expenditure for the purposes authorized by this resolve has been made.

Chapter 573 of the Acts of 1908 provided that no wharf or other structure shall ever hereafter be built or extended in the Connecticut River at Springfield beyond the river line described in chapter 301 of the Acts of 1893, without the permission of the Board of Harbor and Land Commissioners, this act repealing a part of said chapter 301 of the Acts of 1893.

Terminal Facilities.

The resolve under which this Board is acting provides that its report shall contain data concerning terminals, the development and utilization of water power, and other facts pertaining to the subject-matter of this inquiry.

The facts concerning terminal facilities noted on page 20 of this report, and as reported on by the United States engineer officer in 1910, cover practically the situation to-day; that is, existing terminal facilities are in a measure adequate for the present needs.

For handling the business that ought to follow the complete opening of the river to steamers and barges which now pass through Long Island Sound and into the harbors thereon, as well as to New Bedford, Newport, Providence, Fall River and as far as Boston, terminal facilities should be arranged for now by the municipalities bordering on the river, so that there may be shown to Congress that there is not only a willingness but a practical certainty that the people of the Connecticut valley will now, as they have been willing to do for many years, cooperate with the federal government to the fullest extent in providing proper terminals, with rail connections and such appliances for handling freight and passengers as may be required. The Board is satisfied, from replies and other information received from some of the larger municipalities on the Connecticut, that they will acquire, if it is not already owned, the necessary land, and build thereon piers, wharves and docks, to be publicly equipped and owned.

The precise location and dimensions of such terminal facilities can be determined only after a more extended study of this subject than this Board has been able to make within the time allowed, and depends to a certain extent upon the decision of the government in respect to location, width and depth of any projected channel which may be provided in the vicinity of the water front of the various cities and towns.

On March 10, 1913, the Railroad Commissioners filed with the Hampden County Superior Court a plan relating to the improvement of the river front of Springfield, under the pro-

visions of chapter 551 of the Acts of 1907 and chapter 352 of the Acts of 1910. This plan, however, or any plan, before the same can be carried into effect under these statutes, is obliged to receive the approval of the city of Springfield and the railroad companies.

The policy of the Commonwealth has been to appropriate and use public funds, as well as the income of certain funds, in aid of and in extension of the work of river and harbor improvements by the general government, — probably to a larger extent here than in any other State in the Union, — and there can be no possible reason why this policy should not be continued in favor of those great and important rivers, — the Taunton, Merrimac and Connecticut.

Water Power.

Chapter 359 of the Acts of 1909 provided for an investigation of the water power of the Commonwealth, and for determining the best method of utilizing the same. Section 1 authorized the expenditure of $5,000, and section 2 empowered the Governor of Massachusetts to enter into a contract with the Director of the United States Geological Survey for the purpose of making these investigations. It was provided "that said director shall agree to expend a like sum of money within the Commonwealth for the same purposes;" a further provision was "that if said director should find that by reason of the failure of Congress of the United States to provide a general appropriation sufficient to enable him to make an allotment of five thousand dollars for such work in this Commonwealth the Governor may execute a contract for any part of the amount hereby appropriated which part shall be equal to that allotted by the director."

Chapter 622 of the acts of 1911 provided for the completion of the investigations authorized by the act of 1909, and the expenditure of the unexpended part of the appropriation made in 1909. Section 3 provided that "A brief report of the work done under the provisions of this act shall be made to the governor by the director of the United States Geological Survey

on the first day of January, nineteen hundred and twelve, and a final report shall be made by said director to the governor on or before the first day of January, nineteen hundred and thirteen, embodying the complete results of the investigation."

Chapter 564 of the Acts of 1912 provided that $3,000, or such portion thereof as may be necessary, might be expended annually for the purpose of continuing these investigations for a period of five years, and the Governor was empowered to enter into a co-operative agreement with the Director of the United States Geological Survey for the purpose of making the necessary investigations. Section 4 of this act provided that a complete report of the work done under this act should be made to the Governor by the Director of the United States Geological Survey on January 1 of each year in which co-operative work should have been maintained under the authority of this act.

In accordance with the co-operative agreements entered into between the State of Massachusetts and the United States Geological Survey, under authority of the acts above cited, progress reports have, from time to time, been made by the federal government to the Executive of the Commonwealth, which cover, among other localities in Massachusetts, portions of the Connecticut River and its principal tributaries. These reports,[1] however, are very general in character, dealing principally with a general description of certain drainage basins and the installation and maintenance of recording gauges, etc.

The progress report of Dec. 30, 1910, says: —

With the increased population, the continued industrial development, and the resultant demand for power, the water supply of the State becomes more and more valuable. While there is considerable data pertaining to the water supply of Massachusetts, it has been gathered largely by private interests and not all of it is available for public use. The courts are continually called upon to adjust damages and benefits and it is the moral duty of the State to provide reliable records upon which her courts may make equitable decisions, as well as to furnish basic data for water power developments. . . .

The natural facilities for storage on the Connecticut River are perhaps less than on many of the New England rivers, although on Mil-

[1] See water supply paper No. 281, United States Geological Survey.

lers, Chicopee, and Farmington rivers some storage has been developed. There are, however, many locations in this basin where reservoirs could be constructed, and there is much need of systematic effort in this direction as the low-water flow on the Connecticut could be much improved by utilizing some of these opportunities for storage.

The Connecticut Valley Waterway Board has been unable, owing to lack of time and the necessary funds, to make such investigations of the subject of water power and water-power development as it desired, but submits herewith such information as it has been able to gather covering such development at Holyoke and other places on the Connecticut River and some of its tributaries.

The Holyoke Dam.[1]

The Proprietors of Locks and Canals on Connecticut River, under charter granted in 1792, built a dam and canals at South Hadley to enable boats to pass the falls at that point. These navigation works were on the easterly shore of the river and opposite the present city of Holyoke.

After some years of prosperity the profits of the Proprietors declined, owing to railroad competition, and in 1848 the stock was acquired by the Hadley Falls Company. This company proceeded to plan works for the purpose of utilizing the water power available at this point. Chapter 30 of the Acts of 1884 confirmed a deed from the Proprietors of the Locks and Canals on the Connecticut River to the Holyoke Water Power Company and dissolved the first-named corporation.

The first dam built by the Hadley Falls Company was a timber dam, temporary in character, constructed for the protection of a permanent one in process of building. This dam, completed in 1848, was so poorly constructed that when the gates were closed the rush of water carried away the greater part of the dam.

The second and permanent dam, more strongly constructed but also of timber, was finished in October, 1849. While this dam proved strong enough to withstand even extraordinary freshets, various repairs became necessary. By 1868 the con-

[1] Summarized from paper prepared by Albert F. Sickman, hydraulic engineer, in Journal of the New England Water Works Assn., Vol. XVIII., No. 4.

stant fall of water had made depressions in the crest, while the passing of logs had pried out and broken the face timbers. The washing out of the ledge threatened to undermine the dam. To remedy these defects a large apron was built downstream from the dam at a cost of about $300,000. A few years later a new crest was built and the sloping faces of the dam and apron brought up to it.

In 1879 a whirlpool on the surface of the water above the crest of the dam caused an examination to be made, disclosing a break in the plank covering. Cribs were sunk to enclose this, and other holes were discovered.

After continued breaks in the following years, more thorough-going measures were taken in 1885. In this year 20 feet of the top surface was replanked, a row of piling at right angles to the slope placed inside, and the whole filled with gravel. These repairs remedied the leaking to a large extent, but the settlement of the dam continued.

In 1891 plans were begun for a new dam of stone, to be built further downstream. The body of this dam is built of rubble laid in Portland cement mortar. The spillway, upper face, and 5 feet of the top are of heavy granite blocks, the lower blocks fastened with galvanized iron dogs, the top ones with iron dowels. The toe of the dam is protected from erosion and undermining by a heavy bed of rubble masonry, the greater part covered with concrete. The dam was five years in building.

A system of distributing canals, laid out on the nearly level plain enclosed by the bend of the river, consists of three levels.

The water power [1] generated at this dam is distributed to the mill corporations under a form of perpetual lease, recorded like a deed in the registry of deeds. This lease grants the land necessary for the buildings desired as an adjunct to the grant of water power, the price paid being based not upon the amount of land granted, but upon the amount of water power used. The usual form of payment is that of a fixed amount called a bonus, and an additional annual rental.

The Power company regulates the amount taken by the mill

[1] 40,522 H. P., report of U. S. Commissioner of Corporations, March, 1912.

corporations, making its own inspections and measures at the property of the grantees.

The grantors must keep in repair the canals, and must forever maintain the dam. The grantees keep in condition the flumes and raceways, and pay a perpetual annual rent.

By chapter 152 of the Acts of 1909 the Holyoke Water Power Company was authorized to make, manufacture and sell electricity for power purposes and lighting.

This company owns a large frontage on the west bank of the Connecticut River.

Turners Falls Dam.

On Feb. 23, 1792, a law was passed incorporating the Proprietors of Locks and Canals on Connecticut River, — "John Worthington, Esq., and others, for the purpose of rendering Connecticut River passable for boats and other things from the mouth of Chickapee River northward throughout this Commonwealth." By terms of this act the Proprietors were to erect and keep up locks and canals "between the mouth of the Chickapee River, (so called) in Springfield, and the mouth of Stoney-Brook, (so called) in South Hadley, and between the mouth of Deerfield River, (so called) and the head of Millers Falls, (so called) in Connecticut River."

An act of Feb. 27, 1794, authorized the separation of the Proprietors into two companies, one to be called the Proprietors of the Upper Locks and Canals on Connecticut River in the County of Hampshire, and to retain control, rights and privileges of the former company "between the mouth of Deerfield River and the head of Millers Falls."

By chapter 122 of the Acts of 1854 the Proprietors of the Upper Locks and Canals on Connecticut River in the County of Hampshire were authorized to maintain and use their dams, locks and canals, and to construct other dams, locks and canals for the purpose of creating water power to use or sell.

By this act and by chapter 150 of the Acts of 1862 the Proprietors were relieved of all responsibility to support locks, dams and canals for purposes of navigation, to keep such locks and

canals in repair or to maintain the same as a navigable highway.

By chapter 275 of the Acts of 1866 the name of the Proprietors of the Upper Locks and Canals on Connecticut River in the County of Hampshire was changed to the Turners Falls Company.

By chapter 148 of the Acts of 1880 the Turners Falls Company was authorized to construct dams, locks and canals, and was relieved "from the obligation to support its locks, dams and canals for the purposes of navigation, and its said canal is hereby discontinued as a navigable highway."

The first dam built at Turners Falls was under the original charter and was for the purposes of navigation.

In 1866 the Turners Falls Company built a dam with a height of 30 feet and a length of 1,000 feet. The length was in two sections, and the center was supported upon an island near the center of the river.

In 1904 the canal was widened from 50 feet to 150 feet, and increased in length.

During 1912 the erection of a new concrete dam was begun, also the widening and deepening of the canal. The canal will finally be extended to a point below the natural "Rock Dam" near Montague City, where a fall of 60 feet will produce electrical energy equal to 40,000 horse power.

By chapter 197 of the Acts of 1913, the Turners Falls Company was authorized to raise the height of its present dam or to build a new dam in place thereof.

The Turners Falls Company supplies to allied companies water power for mechanical and lighting purposes. The most important of the companies are the Amherst Power Company, Greenfield Electric Light and Power Company, Amherst Gas Company, Easthampton Gas Company and Franklin Electric Company.

It is expected that the improvements now in progress will result in the development of a total of 47,000 horse power.

The Turners Falls Company owns a large frontage on the Connecticut River in the town of Erving.

French King Rapids.

By chapter 580 of the Acts of 1908 the French King Rapids Power Company was incorporated and authorized to construct a dam on the Connecticut River between a point in the town of Gill, on the west side of the river, and some point or points in the town of Northfield or the town of Erving, on the east side of the river, with the necessary power houses, etc., subject to the provisions of chapters 96 and 196 of the Revised Laws.

The foot of these rapids is about 4.34 miles above the dam of the Turners Falls Company. The rapids extend up the river about ½ mile.

On May 1, 1912, plans for construction and maintenance of a dam, with power houses, retaining walls and appurtenances, as authorized by the act aforesaid, submitted by this company, were approved by the Board of Harbor and Land Commissioners, a condition in the written approval being that said company when constructing said dam shall provide a derrick or other suitable means for hoisting over said dam boats or canoes of 25 feet or less in length. No work under this authority has been done.

Water Power on Millers River.

The main stream may be regarded as formed in the town of Winchendon, in northern Worcester county, Massachusetts, by the union of branches from the town of Ashburnham, and from Lake Monomac, the latter on the New Hampshire boundary. The river then pursues an irregular westerly course for about 32 miles, passing into Franklin County joining the Connecticut a little way above Turners Falls. In its upper course it receives Otter River from the south and Tilly river from the north, and those are its principal tributaries, although it is joined by numerous other minor streams. Its drainage area comprises 396 square miles, a small portion of which lies in New Hampshire. Although not a very large stream Millers River is a valuable one for milling purposes on account of its uniform and well-sustained volume. It is quite in contrast to the Deerfield River in this respect, as well as in the character of its valley, which is much more open, in general and better suited to settlement. The fall is also large, amounting in round numbers to 600 feet from Royalston to the mouth, a distance of 23 or 24 miles.

Some thirty individuals and corporations, own, control or use an aggregate of about 7,300 horse-power.

Legislation is now pending for the incorporation of the Millers River Improvement Company, with authority to improve the usefulness of this river and its tributaries and to maintain reservoirs and dams. The Board is informed that if the projected developments are carried out the present horse power will be largely increased, and will amount to between 40,000 and 50,000.

Connecticut River Power Company and New England Power Company.

The Board is indebted to Mr. H. S. Harriman for the following information concerning the various power plants controlled by the Connecticut River Power Company and the New England Power Company: —

The plant on the Connecticut River owned by the Connecticut River Power Company is located between Vernon, Vermont, and Hinsdale, New Hampshire, about five miles north of the Massachusetts line. The plant consists of a dam 650 feet long, and approximately 30 feet high above the average water level of the river. The power station is located on the end of the dam, contains 8 generators of 2500 kilowatts capacity each or a total of 20,000 kilowatts.

At the present time the New England Power Company is constructing four plants on the Deerfield River. Three of these plants are located near Shelburne Falls, and each plant has approximately 63 feet of head. Each power station contains three 2000 kilowatt units giving a total capacity for the three plants of about 18,000 kilowatts. The Fourth plant is located about two miles north of Hoosac Tunnel, and when completed will operate under approximately 200 feet of head. This plant will contain units having a capacity of approximately 12,000 kilowatts. In addition to the above four power plants, the New England Power Company is building a very large storage reservoir in the upper waters of the Deerfield River in the town of Somerset. This reservoir is created by a dam 100 feet high, flooding approximately 2000 acres and having a capacity of approximately 2,700,000,000 cubic feet. This reservoir will very greatly equalize the flow of the Deerfield River and will enable the Power Company to deliver a much larger amount of constant power than would be the case were we dependent merely upon the natural flow of the river.

All of the above plants on the Connecticut and Deerfield Rivers are connected by transmission lines owned by the Connecticut River Transmission Company.

The New England Power Company owns approximately 1,000 feet of fall on the Deerfield River. Its present developments utilize a little under 400 feet and the remaining 600 feet will be developed as rapidly as market conditions warrant.

Statistics.

The Board has given much time and attention to the gathering of statistics relating to population, valuation, value of raw material, value of product and amount of tonnage, and data covering various industries carried on in the Connecticut River valley, and has compared the same with statistics and data heretofore published for the purpose of showing that the increased industrial growth justifies any reasonable expenditure to secure river navigation which will greatly decrease the cost of transportation of commodities, and thereby benefit the industries of this district. The Board has received valuable assistance in this work from the Director of the Massachusetts Bureau of Statistics and from boards of trade, corporations and individuals.

In 1895 Springfield, Holyoke, Chicopee and West Springfield covered an area of about 93 square miles, their population being 114,389, and the assessed valuation, $103,393,020. The combined total value of goods made was about $47,000,000.

In 1911 the same communities, while covering approximately the same area as in 1895, had a population of 181,281 as given in the United States Census, 1910, this being an increase of over 50 per cent. In 1912 the assessed valuation of these communities aggregated $230,581,374, an increase of more than 120 per cent. over the valuation in 1895. In 1911 the combined total value of goods made in these communities was $99,489,139, an increase of more than 100 per cent. since 1895.

The value of stock and materials now used in these communities is approximately 100 per cent. greater than in 1895. Statistics in detail as to the value of stock used and of goods made in the year 1895, in Springfield, Holyoke, Chicopee, and West Springfield, are given as follows in the State Census of 1895: —

	Value of Stock and Material used.	Value of Goods made.
Chicopee,	$2,938,115	$6,667,650
Holyoke,	12,255,556	22,781,222
Springfield,	8,436,384	16,569,228
West Springfield,	920,357	1,365,428
Total,	$24,550,412	$47,383,528

Between 1895 and 1911 the industries of the Connecticut River valley increased to a remarkable extent, as is shown by the following table for the year 1911, compiled from information furnished by courtesy of the Director of the Massachusetts Bureau of Statistics: —

	Value of Stock and Material used, 1911.	Value of Product, 1911.
Springfield,	$15,076,563	$32,607,059
Holyoke,	24,674,515	42,888,084
Chicopee,	12,462,961	19,979,705
West Springfield,	1,999,727	4,014,291
Total,	$54,213,766	$99,489,139

The Board of Harbor and Land Commissioners, in its report (House Document No. 907, 1898), said: —

The most important single commodity from the freight payer's standpoint is coal, and for this the figures are quite complete.

From reports made by brokers, dealers, and large consumers who buy direct from mines, it is stated that the annual coal consumption of Springfield, Holyoke, Chicopee and West Springfield is 447,000 tons. This does not include the coal consumed by the railroads which is probably as much more.

The consumption of coal in Springfield, Holyoke, Agawam, Chicopee, Longmeadow, Ludlow and West Springfield for the year ending Dec. 31, 1912, was: —

	Tons.
Springfield,	716,703
Holyoke,	477,720
Agawam,	14,303
Chicopee,	119,523
Longmeadow,	3,252
Ludlow,	14,944
West Springfield,	40,972
Total,	1,387,417

It was estimated in 1897 that the output of the Holyoke paper mills was about 90,000 tons. For the year ending Dec. 31, 1912, the output of the various mills in Holyoke totalled in excess of 112,600 tons, an increase of over 25 per cent.

In Holyoke and Chicopee it was estimated in 1897 that there were 20,000 tons of raw material used by the cotton mills. This industry has increased to a large extent, as there was received during the year ending Dec. 31, 1912, 63,123 tons of raw material, an increase of over 200 per cent. This material was valued at $15,997,400 and was used in producing finished products valued at $24,975,488.

In 1897 the total freight tonnage of Springfield, Holyoke, Chicopee and West Springfield was given as 1,760,760 tons, both received and forwarded.

The total freight tonnage for the year ending Dec. 31, 1912, was 2,977,900 tons representing an increase of about 68 per cent. The amounts and places for the year 1912, by courtesy of the New York, New Haven & Hartford Railroad Company and the Boston & Albany Railroad Company, are shown as follows: —

Total Freight Tonnage for Year ending Dec. 31, 1912.

Railroads.	Received.	Forwarded.	Total.
Springfield.			
Boston & Albany,	473,550	78,583	552,133
New York, New Haven & Hartford,	490,381	101,263	591,644
Boston & Maine,	187,535	85,970	273,505
Central New England,	2,184	7,249	9,433
Total,	1,153,650	273,065	1,426,715
Holyoke.			
Boston & Maine,	445,414	162,108	607,522
New York, New Haven & Hartford,	405,872	101,552	507,424
Total,	851,286	263,660	1,114,946
Chicopee.			
Boston & Maine,	78,952	17,287	96,239
West Springfield.			
Boston & Albany (New York Central & Hudson River Railroad Co., lessee).	339,000	1,000	340,000

Total Freight Tonnage in 1897 and 1912.

	Received.		Forwarded.		Total.	
	1897.	1912.	1897.	1912.	1897.	1912.
Springfield,	738,706	1,153,650	323,313	273,065	1,062,019	1,426,715
Holyoke,	441,479	851,286	144,996	263,660	586,405	1,114,946
Chicopee,	40,157	78,952	11,495	17,287	51,652	96,239
West Springfield,	36,652	339,000[1]	24,132	1,000	60,694	340,000
Total,	1,255,994	2,422,888	503,866	555,012	1,760,760	2,977,900

[1] Of the 339,000 tons received at West Springfield, 324,000 tons was "company freight," of which approximately 280,000 tons was coal, a large part of which was used on locomotives running out of West Springfield.

Statistics[1] of Manufactures for the year 1911 are as follows: —

Industries.	Number of Establishments.	Capital invested.	Value of Stock and Material used.	Value of Product.
Springfield: —				
Total,	251	$30,861,012	$15,076,563	$32,607,059
Automobiles, including bodies and parts,	8	2,972,594	686,833	2,689,851
Brass castings, and brass finishings,	5	151,761	167,809	278,263
Bread and other bakery products,	18	225,521	486,557	884,214
Carriages and wagons,	5	105,881	65,014	165,734
Electric machinery, apparatus, and supplies,	5	501,927	105,019	273,127
Foundry and machine-shop products,	27	4,695,273	846,028	2,667,066
Gold and silver, leaf and foil,	3	17,630	32,325	48,960
Hardware,	4	327,728	121,957	393,808
Hosiery and knit goods,	4	708,850	348,280	659,744
Lithographing,	3	784,964	166,823	525,404
Lumber, planing-mill products,	7	267,444	307,146	489,288
Mineral and soda waters,	5	37,632	24,724	58,125
Models and patterns not including paper patterns.	4	10,828	4,091	29,962
Paper goods, not elsewhere specified,	7	935,278	602,659	1,118,766
Plumbers' supplies,	4	283,728	109,308	201,268
Printing and publishing, book and job,	7	1,655,052	493,351	1,553,196
Structural ironwork,	4	38,898	38,073	77,243
Tobacco, cigars and cigarettes,	23	299,890	273,837	772,224
Waste,	3	278,704	870,790	1,019,728
Other industries,	105	16,561,429	9,325,939	18,701,088

[1] By courtesy of the Director of the Massachusetts Bureau of Statistics.

Industries.	Number of Establishments.	Capital invested.	Value of Stock and Material used.	Value of Product.
West Springfield,	10	$4,403,792	$1,999,727	$4,014,291
Holyoke: —				
Total,	132	41,877,098	24,674,515	42,858,084
Bookbinding and blank-book making,	4	991,607	664,429	1,323,355
Bread and other bakery products,	17	127,134	241,431	399,731
Foundry and machine-shop products,	14	2,602,782	844,560	2,010,179
Lumber, planing-mill products,	4	298,028	408,140	700,556
Paper and wood pulp,	22	13,542,941	8,304,962	13,626,845
Paper goods not elsewhere specified,	3	763,353	924,030	1,301,568
Sausage, not made in slaughtering and meat-packing establishments.	3	24,620	22,140	35,466
Stationery goods not elsewhere specified,	6	959,924	751,569	1,440,884
Tobacco, cigars and cigarettes,	14	54,151	44,229	121,017
Other industries,	45	22,422,558	12,469,025	21,928,483
Chicopee: —				
Total,	42	18,317,118	12,462,961	19,979,705
Bread and other bakery products,	7	52,642	65,727	121,456
Brick and tile,	4	120,200	21,551	77,500
Other industries,	31	18,144,276	12,375,683	19,780,749
Northampton: —				
Total,	50	15,607,006	3,663,077	7,564,461
Bread and other bakery products,	8	68,414	111,312	194,941
Cutlery and edge tools,	3	409,055	129,771	535,742
Tobacco, cigars and cigarettes,	5	15,477	12,917	33,461
Other industries,	34	15,054,150	3,408,077	6,800,317
Agawam,	3	436,879	205,224	626,011
Deerfield,	7	218,057	177,065	356,667
Easthampton,	18	5,758,278	5,284,667	9,008,744
Greenfield,	31	2,483,395	1,173,655	3,207,279
Bread and other bakery products,	3	25,889	64,352	94,897
Foundry and machine-shop products,	5	384,119	111,368	506,619
Tools not elsewhere specified,	7	987,251	268,297	1,157,682
Other industries,	16	1,086,136	729,738	1,448,081
Montague,	18	3,254,790	1,232,343	2,418,426
Bread and other bakery products,	4	17,925	24,029	41,635
Paper and wood pulp,	3	2,474,221	950,699	1,656,819
Other industries,	11	762,644	257,615	719,972
South Hadley,	9	1,503,003	735,177	1,301,849

As has been stated, there was 1,387,417 tons of coal, including hard and soft, consumed in Holyoke, Springfield and surrounding territory during the year 1912. While it is difficult to arrive at any very satisfactory figures for comparison between water and rail freight rates on coal, it is safe to assume that should the river be improved as far as Holyoke, and coal wharves and pockets at Springfield and Holyoke be provided, the result would be a saving to the consumer of not less than 80 cents per ton on coal carried to these places by river.

On other commodities, such as lumber, rubber, manure, pulp, cotton, paper, paper waste, rags, tobacco, sugar, etc., if the necessity for transhipment at Hartford is obviated, there would be a saving to the consumer of approximately from 10 to 15 per cent.

The Enfield Dam and Rapids and the Situation at Windsor Locks.

During 1908 and 1909 there were introduced into Congress by the Enfield Power Company, the Northern Connecticut Power Company and the Connecticut River Company, three bills for certain rights and privileges relating to the building of a dam and lock, and relocating the dam of the Connecticut River Company across the Connecticut River at Windsor Locks in Connecticut, where a canal and locks, completed by the Connecticut River Company about 1830, existed, and which had for many years been inadequate for use by any but small water craft.

In February, 1912, a hearing was held on these bills before a subcommittee of the Committee on Commerce of the Senate, at Washington. Representatives of the Rivers, Harbors and Bridges Commission of Connecticut appeared before this subcommittee and urged the passage of an act which would permit the building of structures and the improvement of the river for navigation purposes above Hartford, and restore navigation to Springfield and other places. Subsequently, the stockholders of the Connecticut River Company relinquished, by vote, their right to charge tolls, and in October, 1912, public announcement was made that the Connecticut River Company and the

Northern Connecticut Power Company had reached an agreement, and that the controversy had been settled, leaving the way clear for power development on a large scale, of approximately 30,000 horse power, and the development of the river after favorable action by Congress.

The active co-operation of the Connecticut Rivers, Harbors and Bridges Commission with this Board in matters concerning navigation as far as Holyoke has been alluded to elsewhere in this report, and it was exceptionally helpful at a conference of the members of the two Boards in November last, when the provisions of a bill to be presented by the Connecticut River Company to Congress were discussed.

The members of the Connecticut Valley Waterway Board, in December, conferred with the Acting Chief of Engineers, U. S. A., in Washington, on the subject-matter and certain provisions of the bill prepared by the Connecticut River Company, and subsequently appeared before the Committee on Commerce of the Senate, and were heard in favor of the bill. During its recent investigations at Washington the Board was greatly assisted by the effective aid and co-operation of Hon. George P. Lawrence, member of the House of Representatives, and by the two United States Senators from Massachusetts.

Following the hearing before the Committee on Commerce, there was introduced into the Senate of the United States, on Jan. 8, 1913, a bill "To authorize the Connecticut River Company to relocate and construct a dam across the Connecticut River above the village of Windsor Locks, in the State of Connecticut," which was as follows: —

62D CONGRESS, 3D SESSION.

[S. 8033.]

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the assent of Congress is hereby given to the Connecticut River Company, a corporation organized and doing business under the laws of the State of Connecticut, to relocate its "Enfield Dam," so called, and to construct, maintain, and operate such relocated dam (which if located opposite Kings Island, in said river, shall extend across both branches of the river), together with works appurtenant and necessary thereto, across the Connecticut River at any point below a line crossing both branches of the

river and Kings Island midway between the northerly and southerly ends of said island: *Provided,* That, except as may be otherwise specified in this Act, the location, construction, maintenance, and operation of the structures herein authorized, and the exercise of the privileges hereby granted, shall be in accordance with the provisions of the Act approved June twenty-third, nineteen hundred and ten, entitled "An Act to amend an Act entitled 'An Act to regulate the construction of dams across navigable waters,' approved June twenty-third, nineteen hundred and six": And *provided further,* That the time for completing said dam and appurtenances may be extended by the Secretary of War, in his discretion, two years beyond the time prescribed in the aforesaid Act: And *provided further,* That the rights and privileges hereby granted may be assigned with the written authorization of the Secretary of War, or in pursuance of the decree of a court of competent jurisdiction, but not otherwise: And *provided further,* That the Secretary of War, as a part of the conditions and stipulations referred to in said Act, may, in his discretion, impose a reasonable annual charge or return, to be paid by the said corporation or its assigns to the United States, the proceeds thereof to be used for the development of navigation on the Connecticut River and the waters connected therewith. In fixing such charge, if any, the Secretary of War shall take into consideration the existing rights and property of said corporation and the amounts spent and required to be spent by it in improving the navigation of said river, and no charge shall be imposed which shall be such as to deprive the said corporation of a reasonable return on the fair value of such dam and appurtenant works and property, allowing for the cost of construction, maintenance and renewal, and for depreciation charges.

SEC. 2. That the height to which said dam may be raised and maintained shall not be less than thirty-nine feet above zero on the Hartford gauge: *Provided,* That said corporation shall permit the continuous discharge past said dam of all water flowing in the Connecticut River whenever the discharge into the pool created by the dam hereby authorized is one thousand cubic feet per second or less, and at all greater discharges into said pool shall provide a minimum discharge past said dam of not less than one thousand cubic feet per second: And *provided further,* That said corporation may, for not to exceed five hours between sunset and sunrise, limit the discharge past said dam to five hundred cubic feet per second whenever such limitation will not, in the opinion of the Secretary of War, interfere with navigation. The measure of water thus to be discharged shall include all the water discharged through the lock herein provided for and the present locks and canal of said corporation: And *provided further,* That nothing in this Act shall in any way authorize said corporation at any time or by any means to raise the surface of the river at the location just above the present Enfield Dam to any height which shall raise the surface of the river at the lower tailrace of the Chemical Paper Company in

Holyoke, Massachusetts, higher than can result from the erection or maintenance of any dam or dams which said corporation is authorized to erect or maintain in accordance with the order and decree of the Circuit Court of the United States for the District of Connecticut, passed June sixteenth, eighteen hundred and eighty-four, in the case of The Holyoke Water Power Company against the Connecticut River Company.

SEC. 3. That the said Connecticut River Company shall build coincidently with the construction of the said dam and appurtenances, at a location to be provided by said corporation and approved by the Secretary of War, and in accordance with plans approved by the Secretary of War and the Chief of Engineers, a lock of such kind and size, and with such equipment and appurtenances as shall conveniently and safely accommodate the present and prospective commerce of the river, and when the said lock and appurtenances shall have been completed the said corporation shall convey the same to the United States, free of cost, together with title to such land as may be required for approaches to said lock and such land as may be necessary to the United States for the maintenance and operation thereof, and the United States shall maintain and operate the said lock and appurtenances for the benefit of navigation, and the said corporation shall furnish to the United States, free of charge, water power, or power generated from water power, for operating and lighting the said constructions; and no tolls or charges of any kind shall be imposed or collected for the passage of any boat through the said lock or through any of the locks or canal of said corporation.

SEC. 4. That compensation shall be made by the said Connecticut River Company to all persons or corporations whose lands or other property may be taken, overflowed, or otherwise damaged by the construction, maintenance, and operation of the said dam, lock, and appurtenant and accessory works, in accordance with the laws of the State where such lands or other property may be situated; but the United States shall not be held to have incurred any liability for such damages by the passage of this Act.

SEC. 5. That upon the termination for any cause whatever of the authority, rights, and privileges granted hereby, or any renewal thereof, the United States may renew the same or the grant may be made or transferred to other parties. Unless the grant is renewed to the original grantee or its assigns, as herein provided, the United States shall pay or require its new grantee to pay to said original grantees or its assigns, as full compensation, the reasonable value of the improvements and appurtenant works constructed under the authority of this Act and of the property belonging to said corporation necessary for the development hereby authorized, exclusive of the value of the authority hereby granted. Said improvements and appurtenant works and property shall include the lands and riparian rights acquired

for the purposes of such development, the dam and other structures, and also the equipment useful and convenient for the generation of hydroelectric power or hydromechanical power, and the transmission system from generation plant to initial points of distribution, but shall not include any other property whatsoever. Such reasonable value shall be determined by mutual agreement between the Secretary of War and the owners, and, in case they can not agree, then by proceedings instituted in the United States district court for the condemnation of such properties. The basis for determining the value shall be the cost of replacing the structures necessary for the development and transmission of hydroelectric power by other structures capable of developing and transmitting the same amount of marketable power with equal efficiency, allowance being made for deterioration, if any, of the existing structures in estimating such efficiency, together with the fair value of other properties herein defined, to which not more than ten per centum may be added to compensate for the expenditure of initial cost and experimentation charges and other proper expenditures in the cost of the plant which may not be represented in the replacement valuation herein provided.

SEC. 6. That the right to alter, amend, or repeal this Act is hereby expressly reserved.

After twice reading, this bill was referred to the Committee on Commerce and reported without amendment on Jan. 20, 1913, by Mr. Burton, representing a majority of the committee. This report, accompanying Senate 8033, in view of its importance, is given in full.

The majority of the Committee on Commerce, to which was referred the bill (S. 8033) to authorize the Connecticut River Co. to relocate and construct a dam across the Connecticut River above the village of Windsor Locks, in the State of Connecticut, report the same to the Senate without amendment, and recommend that the same do pass.

This bill provides a means by which, without expense to the Federal Government, a very important section of the Connecticut River between the towns of Hartford, Conn., and Springfield and Holyoke, Mass., may be improved for purposes of navigation. This reach of the stream contains a heavy fall known as the Enfield Rapids, which constitute a serious obstacle to its navigability. At present the practical navigation of the stream for commercial purposes ceases at the city of Hartford. Above this point the river is navigable only for boats of slight draft and small capacity. Somewhat more than 80 years ago the State of Connecticut chartered the Connecticut River Co., which is the grantee under this bill, as a navigation company, and for the

purposes of affording navigation around these rapids the said company constructed a canal and lock, which it still operates. Originally the revenues of the company were derived from tolls imposed upon boats using this canal. At a later date the water power created by their dam was commercially utilized and the company thereafter derived its revenues from this source and voluntarily abolished the tolls. Subsequently the State of Connecticut amended the charter of the navigation company, granting it the right to generate, use, and sell hydroelectric power.

The conditions in this stream are typical of a large class of river improvements which the Federal Government is called upon to make. The large expenditures already required to improve rivers more naturally suited to purposes of navigation usually preclude the possibility of attempting to improve streams of comparatively small flow, or where obstructed with difficult rapids, unless a large portion of the expense can be derived from the stream itself by utilizing the value of the water power possibilities. In principle it would appear to be eminently just that revenues for improving streams of this class should be derived from the privilege granted and not assessed against taxpayers in general. It would also seem exceedingly desirable that the maximum beneficial use of streams, both for navigation and water power, should be secured in the interest of the fullest conservation of our natural resources. Evidently the improvement of certain streams can best be accomplished where these two purposes are co-ordinated and carried on together.

In the present instance this bill grants to the Connecticut River Co. the right to construct a dam at a point in the Connecticut River below a line crossing both channels of the river and Kings Island midway between its northerly and southerly end. The act provides that the dam shall be constructed in accordance with the provisions of the general dam act, approved June 23, 1910, with certain modifications, which will be noted in the subsequent portion of this report.

According to the provisions of the bill a lock must be constructed in connection with the dam of such size and design as the Chief of Engineers and the Secretary of War may require. The plan if carried out will thus provide slack-water navigation between Hartford and Holyoke, adequate to meet the present and prospective commerce of this reach of the stream. The dam will also develop the full power possibilities of this portion of the river.

It appears to be a settled question that the Federal Government may impose a charge for the use of the surplus water, not needed for purposes of navigation, which may be made available incidentally to the construction of a dam by the Federal Government for purposes of navigation. It would seem equally evident that the Federal Government also has the right to utilize a private agency for the construction of dams in aid of navigation, granting the use of the incidental water

power thereby created to the constructing company in compensation, and requiring such other return as the circumstances may warrant.

The bill presented marks the most distinct step yet taken toward this method for the improvement of navigation in combination with hydroelectric development under the control and supervision of the Federal Government, but without Federal expenditure. In addition to the requirement that the company shall construct the dam, lock, and all works appurtenant thereto, without expense to the Federal Government, it is also provided that the Secretary of War, as a part of the conditions and stipulations referred to in the general dam act, may in his discretion impose a reasonable annual charge or return to be paid by the said corporation or its assigns to the United States, the proceeds thereof to be used for the further development of navigation in the Connecticut River and waters connected therewith. It is provided, however, that no charge shall be imposed which shall be such as to deprive the said corporation of a reasonable return upon its actual and necessary investment.

The public interests seem to be fully safeguarded in this instance against exorbitant charges, because the generation and sale of electricity in the territory covered by this development are under the jurisdiction, both in Connecticut and Massachusetts, of well-organized utility commissions under State authority. It is believed that the authority of the Secretary of War to require a return to the Government in case the corporation earns more than a reasonable return upon its bona fide investment will be in effect a regulation of the charges of the company as well as a source of revenue to the Government, because it will be one of the most important factors to be taken into consideration by the commissions mentioned in fixing the rates of service which the company may charge. The provision, therefore, complies with the recommendation of the National Waterways Commission in its final report (p. 61), which reads as follows:

Charges and regulation. — That a grant for water-power development constitutes a special privilege, for which the Government is entitled to proper compensation, is a principle which should be clearly established. The actual value of such privilege will, of course, vary greatly under different conditions. Every grant of the Government should, however, be dependent on the payment of such reasonable charges as may be determined by the circumstances and equities involved in each case. The commission does not suggest or advise that this right or power of Congress should be invoked as a means of raising revenue for general purposes, but only to reimburse the Government for the cost of surveys, inspection, and similar expenses, and for the purpose of controlling the use of streams in the interest of the public.

The most important departures from the provisions of the general dam act as approved June 23, 1910, are as follows:

In the first section it is provided that the Secretary of War may, in his discretion, for adequate reasons, extend the period for the completion of the dam two years beyond the prescribed limits of the general dam act. The extension of time contemplated appeared to the committee reasonable, considering the difficulty of construction likely to be encountered.

In the same section it is provided that the rights and privileges granted under the act may not be assigned except upon the written authorization of the Secretary of War, except in pursuance of a decree of a court of competent jurisdiction. This provision was inserted with the intention of preventing its assignment for the purpose of creating monopolistic combination, a danger which should be carefully guarded against.

Section 2 contains numerous provisions intended to insure the primary operation of the dam and lock in the interests of navigation, while section 3 provides for the construction of a lock, in accordance with plans to be approved by the Secretary of War and Chief of Engineers, coincidentally with the construction of a dam, and contains the provision of the general dam act requiring the company to convey the completed lock and appurtenances to the United States free of cost, together with such land as may be required for approaches and for the maintenance thereof, and to furnish the United States free of cost power for operating and lighting such lock and property.

Section 5 contains a provision materially different from those of former grants of this character. It is provided that at the expiration of the 50-year period contemplated by the general dam act the original grant may be renewed, transferred to other parties, or withheld. In the event that the grant is transferred to other parties, the Government shall require as a condition of the transfer of the property that the new grantee shall compensate the original grantee for the property acquired at a reasonable valuation. In the event that the United States refuses to renew the grant it shall itself make such compensation.

This provision is based upon the theory that if the Federal Government restricts its grantee to reasonable earnings, which appears to be a policy necessary to enforce in the interests of the public, it shall also provide, as far as may be expedient, for the security of the necessary bona fide investment. The effect of this stipulation will be to cure, in its application to this grant, an undoubted defect of the general dam act and to make this system of legislation conform to the well-known methods obtaining in the case of long leases of land, providing for an appraisal and purchase of improvements at the expiration of the lease.

The majority of the committee feel that the provisions contained in this bill are exceedingly desirable, both in the interests of an enlarged improvement of a certain class of streams and also for the utilization of our water powers under provisions which will safeguard fully the public interests, and therefore earnestly recommend the passage of this bill.

Attached hereto will be found copy of a letter from the Secretary of War, addressed to the chairman of the Senate Committee on Commerce, which indicates that he is fully in accord with the provisions of the bill.

WAR DEPARTMENT, WASHINGTON, January 2, 1913.

MY DEAR SENATOR: — I beg to respond to the kind request of your committee for an expression of my views as to —

"A bill for the improvement of navigation of the Connecticut River and authorizing the Connecticut River Company to relocate and construct a dam in said river above the village of Windsor Locks, in the State of Connecticut."

It is understood that this bill is intended to replace three bills of a similar import, as to which I reported to your committee under date of April 18 last.

As reported to me by the Chief of Engineers, the Connecticut River between Hartford, Conn., and Holyoke, Mass., calls for improvements in the interest of navigation which are delayed owing to the very large cost of such improvements if independently undertaken by the Government. If, however, the improvement of navigation could be combined with a project for water-power development, whereby the cost of the improvement demanded by the interest of navigation would not devolve upon the Government, the adoption of such a plan would be plainly in the public interest. The bill now under consideration seeks thus to combine the commercial interests of navigation with the interests of water-power development and, it is believed, provides the most economical method of securing the improvement of the river sufficient for the present and prospective commerce. From the reports submitted to Congress, in accordance with the river and harbor act of March 3, 1909 (H. Doc. No. 818, 61st Cong., 3d sess.), it appears that the lock necessary for navigation purposes alone was estimated to cost $430,000; and inasmuch as this estimate was made several years ago it is probable that the cost to-day will be considerably larger. In addition to this, if the improvement of the Enfield Rapids were to be undertaken by the Federal Government directly, the necessity for purchasing flowage rights and extinguishing vested interests acquired under State law would add considerably to the actual cost of the work, and would doubtless present legal complications that would greatly embarrass the consummation of the improvement.

Therefore, from the standpoint of navigation, I am of the opinion that the project embraced in the bill whereby the lock and dam are built by the grantee as an agency of the Federal Government is very advantageous to the United States. On the other hand, the bill will give to the Connecticut River Co. very valuable water-power rights in connection with this work of improvement. The case thus falls within the principles which the President has laid down in his veto message of August 24, 1912, on the Coosa River dam bill (S. 7343, 62d Cong., 2d sess.) and calls for a reassertion of the views I have heretofore expressed on bills of similar import, as to which I have previously reported to your committee. In other words, I think the bill should not become law unless a provision is added giving the Secretary of War authority, as one of the conditions

of the privilege granted by the act, to require the grantee to pay to the United States a reasonable annual return, after making due allowance for construction, renewals, depreciation charges, and a reasonable return to the grantee on his bona fide investment, such proceeds to be devoted to the interests of navigation. With such a provision, I am of the opinion that the bill is in the interests of the public, and I strongly urge enactment.

After conference with the representatives of the Connecticut River Co., they have consented to the insertion in the bill of an amendment to meet my views as to the provision for compensation which I deem vital to its enactment. It is contained in the last proviso of section 1 of the inclosed draft of the bill. I have also examined the remainder of the annexed draft, containing certain minor amendments proposed by the Connecticut River Co., and believe that the interests of the Government, from the standpoint of my department, are adequately safeguarded thereby.

Very respectfully,

HENRY L. STIMSON,
Secretary of War.

HON. KNUTE NELSON,
Chairman of Committee on Commerce, United States Senate.

A minority of the Committee on Commerce, represented by Mr. Bankhead, dissented from the report of Mr. Burton, and submitted a minority report suggesting certain amendments. These amendments consisted of the striking out of the provisions regarding assignment of rights and privileges granted, and of the provision allowing the Secretary of War to impose an annual charge upon the corporation.

The bill, as amended, was passed by the Senate on Feb. 17, 1913. As in its amended form there was little likelihood of its passing the House, an attempt was made to attach it as a rider to the general rivers and harbors bill. The failure of this attempt leaves the consideration of this matter to be renewed at the coming session of Congress.

The failure of Senate No. 8033 leaves the whole question of navigation at Enfield dam again in abeyance. Upon the judicious adjustment of this situation depends the whole matter of Connecticut River improvement above Hartford. The Board strongly recommends the expression of a vigorous public sentiment in favor of the enactment by Congress of a law similar to Senate No. 8033, as the essential condition of free navigation of the Connecticut River above Hartford.

Conclusions and Recommendations.

The conclusions and recommendations of the Connecticut Valley Waterway Board are: —

1. The demands of the cities and towns in the Connecticut River valley between Holyoke and the southerly boundary line of Massachusetts for ample facilities for navigation on the Connecticut River from Long Island Sound to the present head of navigation near the Holyoke dam, in order that they may benefit by a saving in freight charges on coal, cotton, lumber and other commodities which might be brought by water, and on manufactured articles which might be shipped by water from this community, should be urged before Congress. The State of Massachusetts, if necessary, should co-operate with the cities and towns in that section of the Commonwealth by making sufficient appropriations for defraying a part of the cost of doing such work as may be required by plans and projects which may be adopted by the federal government for providing such facilities for navigation.

2. The depth of water which should now be provided in that part of the Connecticut River between Hartford and Holyoke should be not less than that now available from Long Island Sound to Hartford. A depth of 12 feet would enable the class of barges which now pass through the new Barge Canal to proceed through Long Island Sound and up this river as far as Springfield and Holyoke. Whenever the present depth to Hartford is increased, a corresponding increase should be made in the depth of the channel as far as Holyoke.

3. In any law enacted by Congress for the construction of a dam across the Connecticut River at any point thereon between the mouth of said river and the Holyoke dam, it should be provided that a lock be built in said dam of sufficient dimensions for the convenient passage of water craft. Plans for said dam should provide for a depth over the sill in the lock not less than the ultimate depth to be provided in said river between its mouth and Hartford.

4. Any law enacted by Congress for the construction of a

dam across the Connecticut River at any point thereon between the mouth of said river and the Holyoke dam, which provides not only for the improvement of navigation but also for the development of power for commercial or other uses, should require payment to the federal government for the privilege granted.

5. It is recommended that in case any corporation, duly authorized by Congress to relocate and construct a dam across the Connecticut River at Windsor Locks in the State of Connecticut, should fail to build the same, then the Board of Harbor and Land Commissioners, acting jointly with representatives of the State of Connecticut, shall investigate the matter and report to the General Court such plan or plans as it may deem necessary or desirable for relocating and constructing said dam, with a lock therein, the work to be done by the State of Massachusetts and the State of Connecticut acting jointly, for the purpose of improving navigation on said river and developing and utilizing the water power at this locality.

6. The several cities and towns bordering on the Connecticut River in the State of Massachusetts, both above and below the Holyoke dam, should acquire, by purchase or otherwise, a part of the water front, the same to be reserved for commercial purposes and use in connection with an improved river channel.

7. The several cities and towns bordering on the Connecticut River should build, equip, operate and control such piers, wharves, docks and landings on the river frontage, with suitable rail connections between the same and any existing railroad, as may from time to time be necessary for use in connection with an improved river channel, there being at the present time an opportunity to acquire land for this purpose, under favorable conditions.

8. The Commonwealth should co-operate with the several cities and towns bordering on the Connecticut River in providing channels of approach from the main channel and terminal basins in said river, to such piers, wharves, docks, and landings, as may be necessary, and should pay the cost of providing such approach channels and terminal basins.

9. River lines should be established by the Commonwealth from time to time along the Connecticut River, limiting the projection into the river of structures built along its banks under authority of law.

10. A survey should be made by the Board of Harbor and Land Commissioners for the purpose of determining the depth of water and the character of the bottom of the river from a point a short distance below the Holyoke dam to the northerly boundary line of Massachusetts; also surveys, plans and estimates of cost of providing canals, locks and other necessary works at or near the rapids and dams on said river at Holyoke and Turners Falls, also at French King Rapids and at all other places on said river where work of this character would be necessary in reopening to navigation the whole length of the Connecticut River in Massachusetts above the Holyoke dam.

11. Surveys and examinations should be made by the Board of Harbor and Land Commissioners of the tributaries of the Connecticut River for the purpose of ascertaining facts concerning water power, improved and unimproved, and other necessary and useful data.

12. It is recommended that further appropriations be made for protective work along the banks of the Connecticut River; also appropriations for such work along the banks of the tributaries of said river, to be carried out in such places and to such extent as the Board of Harbor and Land Commissioners may deem necessary; and that all work of this character be done under the charge and direction of said Board.

13. It is recommended that legislation be provided authorizing and directing the Board of Harbor and Land Commissioners, acting with such representatives of the States of New Hampshire and Vermont as may be appointed for the same purpose, to consider and formulate plans for conserving the head waters of the Connecticut River.

14. The Board recommends that the Legislature adopt resolutions in favor of a full and complete development of the entire length of the Connecticut River in Massachusetts, and that the Commonwealth co-operate with the federal government in

carrying into effect projects of improvement for the benefit of navigation, and appropriate from time to time the necessary funds for use in connection with such appropriations as may be made by Congress for the improvement and development of the whole river in accordance with such plans and projects as may be adopted by the United States.

WILLIAM S. McNARY, *Chairman.*
CHARLES P. CHASE,
JAMES J. O'DONNELL,
Connecticut Valley Waterway Board.

MARCH 12, 1913.

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